Remarks

The present amendment responds to the Official Action dated October 5, 2004. The Official Action requests affirmation of an election to prosecute the invention of Group I discussed in a telephone call on August 26, 2004. The Official Action objected to the Abstract section of the Specification for the use of the phrase "a covariance matrix are described." The Official Action objected to claims 7-8 and 21-22 for having the same limitations cited in claims 2-3 and 16-17. The Official Action rejected claims 15-28 under 35 U.S.C. §102(b) as being anticipated by Garde U.S. Patent No. 5,896,543 (Garde). Claims 1-14 and 37-41 were rejected under 35 U.S.C. §103(a) based on Garde in view of Kohn U.S. Patent No. 5,204,828 (Kohn). These grounds of rejection are addressed below.

Claims 1, 9, 15, 21, 23, and 37 have been amended to be more clear and distinct. Specifically, these claims have been amended to clarify that various types of complex multiplications may be performed by the present invention. These amendments merely restate the existing limitations of the claim and are not intended to limit the scope in any way. Claims 7, 8, 21, 22, and 29-36 have been canceled without prejudice. Claims 1-6, 9-20, 23-28, and 37-41 are presently pending.

Election/Restriction

A provisional election was made in a telephone call on August 26, 2004 with the Examiner. This amendment confirms the Applicants' election to prosecute the invention of

Group I drawn to complex multiplication, claims 1-28 and 37-41. Thus, claims 29-36 have been canceled without prejudice.

Objection to Abstract

The Official Action objected to the wording "a covariance matrix are described." Although Applicants do not acquiesce in the reasoning of this objection, the Abstract beginning at page 23, line 2 has been amended to describe a specific embodiment of the present invention according to MPEP §608.01(b).

Objection to Claims 7-8 and 21-22

Although Applicants do not acquiesce to this objection, claims 7-8 and 21-22 have been canceled without prejudice.

Typographical Errors in the Specification

In preparing of this amendment, several typographical errors were found in the Specification. To be consistent with Fig. 8, reference numbers used in the paragraph beginning at page 11, line 7 have been corrected to refer to accumulators 833 and 835.

Also, to be consistent with Fig. 8, a reference number used in paragraph beginning at page 11, line 16 has been corrected to refer to register 847.

The Art Rejections

As addressed in greater detail below, Garde and Kohn do not support the Official Action's reading of them and the rejections based thereupon should be reconsidered and withdrawn. Further, the Applicants do not acquiesce in the analysis of Garde and Kohn made by the Official Action and respectfully traverse the Official Action's analysis underlying its rejections.

The Official Action rejected claims 15-28 under 35 U.S.C. §102(b) as being anticipated by Garde. Garde describes a multiplier/accumulator 120 used to execute a 16 bit complex word instruction. Garde, col. 13, lines 52-53 and Fig. 12C. Referring to Fig. 12C and col. 13, lines 60-65 of Garde, four 16x16 multipliers 602, 604, 606, and 608 are connected in a fixed fashion. Outputs of multipliers 602 and 608 connect to subtractor 624. Outputs of multipliers 604 and 606 connect to adder 626. When multiplying two complex numbers, Xr+Xi and Yr+Yi, it appears Garde's arrangement of multipliers and adders can only perform the following calculation: (Xr*Yr)-(Xi*Yi) for the real result and (Xr*Yi)+(Xi*Yr) for the imaginary result.

Unlike Garde, the present invention supports performing a plurality of types of complex multiplication such as multiply complex long, multiply complex conjugate long, multiply complex long accumulate, and multiply complex conjugate long accumulate, for example. To this end, the present invention advantageously employs a multiplexer coupled to a multiplier means and an adder means to select which products produced from the multiplier means are added to or subtracted from each other based on the type of complex multiplication being performed. Claim 15, as presently amended, reads as follows:

15. An apparatus for the single cycle computation for a plurality of types of complex multiplication, the apparatus comprising:

a first storage means for storing a first complex operand and a second complex operand, the first complex operand including real component Xr and imaginary component Xi, the second complex operand including real component Yr and imaginary component Yi;

multiplier means for simultaneously performing multiplications in a first cycle of operation to produce products Xr*Yr, Xr*Yi, Xi*Yr and Xi*Yi;

adder means for simultaneously performing additions and subtractions in the first cycle of operation to produce real result (Xr*Yr)-(Xi*Yi) and imaginary result (Xr*Yi)+(Xi*Yr) if the type of complex multiplication being performed is a nonconjugated operation, said adder means further for simultaneously performing additions and subtractions in the first cycle of operation to produce real result (Xr*Yr)+(Xi*Yi) and imaginary result (Xi*Yr)-(Xr*Yi) if the type of complex multiplication being performed is a conjugated operation;

a multiplexer coupled to the multiplier means and the adder means, said multiplexer selecting which produced products are added to or substracted from each other based on the type of complex multiplication being performed; and

a third storage means for storing the results of said adder means.
(emphasis added)

See also claim 21, as presently amended, where now recites "a logical array coupled to the multiplier means and the adder/accumulator means, said logical array aligning the produced products to determine which produced products are added to or subtracted from each other based on the type of complex multiplication being performed."

Garde does not disclose and does not make obvious a "multiplexer selecting which produced products are added to or substracted from each other based on the type of complex multiplication being performed," as presently claimed in claim 15. Garde does not disclose and does not make obvious a "logical array aligning the produced products to determine which produced products are added to or subtracted from each other based on the type of complex multiplication being performed," as presently claimed in claim 21.

The Official Action suggests that Garde at Fig. 12C purportedly discloses an extended precision storage means. Applicants disagree. Referring to Fig. 12C, numbers having a 16 bit real component and a 16 bit imaginary component are being multiplied. When multiplying 16 bit numbers, the minimum storage space needed to store any combination of 16 bit multiplication is 32 bits. Consequently, the minimum storage space need to store any combination of 16 bit multiplication for the real result and the imaginary result is 64 bits. Garde's result register 620 is only 64 bits long. Therefore, only the minimum storage is disclosed in Garde's system.

Unlike Garde, dependent claim 17 requires an "extended precision storage means" which is utilized "for storing extended precision results of said accumulator means." Garde does not disclose and does not make obvious an "extended precision storage means" as claimed.

Claims 1-14 and 37-41 were rejected under 35 U.S.C. §103(a) based on Garde in view of Kohn. Kohn describes a bus control apparatus for performing dual arithmetic operation in a microprocessor capable of executing floating-point operations. Kohn, col. 3, lines 42-43. The Official Action relies on Kohn as purportedly teaching the performing of a set of multiplications in one cycle and a set of additions performed in two cycles. However, Kohn does not cure the deficiencies of Garde as a reference as described above.

Claim 1, as presently amended, reads as follows:

> 1. An apparatus for the two cycle computation of a plurality of types of complex multiplication, the apparatus comprising:
> a first storage means for storing a first complex operand and a second complex operand, the first complex operand including real component Xr and imaginary component Xi, the second complex operand including real component Yr and imaginary component Yi;
> multiplier means for simultaneously performing multiplications in a first cycle of operation to produce products Xr*Yr, Xr*Yi, Xi*Yr and Xi*Yi;

a second storage means for storing products Xr*Yr, Xr*Yi, Xi*Yr and Xi*Yi;

adder means for simultaneously performing additions and subtractions in a second cycle of operation to produce real result (Xr*Yr)-(Xi*Yi) and imaginary result (Xr*Yi)+(Xi*Yr) if the type of complex multiplication being performed is a nonconjugated operation, said adder means further for simultaneously performing additions and subtractions in the second cycle of operation to produce real result (Xr*Yr)+(Xi*Yi) and imaginary result (Xi*Yr)-(Xr*Yi) if the type of complex multiplication being performed is a conjugated operation;

a multiplexer coupled to the multiplier means and the adder means, said multiplexer selecting which produced products are added to or subtracted from each other based on the type of complex multiplication being performed; and

a third storage means for storing the results of said adder means.
(emphasis added)

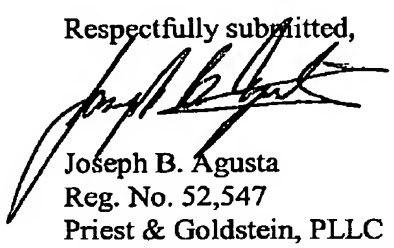
Kohn and Garde, taken separately or in combination, do not teach and do not suggest "an apparatus for performing a plurality of types of complex multiplication" as presently claimed in claim 1. Kohn and Garde, taken separately or in combination, do not teach and do not suggest "a multiplexer coupled to the multiplier means and the adder means, said multiplexer selecting which produced products are added to or subtracted from each other based on the type of complex multiplication being performed." Consequently, even if the teachings of Kohn and Garde are combined as suggested, the features of these claims are not met.

Nothing in the cited references indicates a recognition of the problem of supporting various types of complex multiplication as claimed by the present invention. Further, nothing in the cited references indicates a structure which would solve the problems addressed by the present invention. The claims of the present invention are not taught, are not inherent, and are not obvious in light of the art relied upon.

Conclusion

All of the presently pending claims, as amended, appearing to define over the applied references, withdrawal of the present rejection and prompt allowance are requested.

Respectfully submitted,



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